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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/022,595	12/13/2001	Thomas Patrick Smyth	GCSD-1156 (51225)	5966
27975	7590	10/26/2004	EXAMINER	
ALLEN, DYER, DOPPELT, MILBRATH & GILCHRIST P.A. 1401 CITRUS CENTER 255 SOUTH ORANGE AVENUE P.O. BOX 3791 ORLANDO, FL 32802-3791			THOMAS, ERIC W	
			ART UNIT	PAPER NUMBER
			2831	

DATE MAILED: 10/26/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/022,595	<b>Applicant(s)</b> SMYTH ET AL.	
	<b>Examiner</b> Eric W Thomas	<b>Art Unit</b> 2831	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 06 July 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-42 is/are pending in the application.
- 4a) Of the above claim(s) 1-28 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 29-42 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 March 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |                                                                                                    |                                                                             |
|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)               | Paper No(s)/Mail Date. _____                                                |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>12/13/02</u> .                                                            | 6) <input type="checkbox"/> Other: _____                                    |

**DETAILED ACTION**

***Election/Restrictions***

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
  - I. Claims 1-15, drawn to a method making an electronic module, classified in class 29, subclass 832.
  - II. Claims 16-28, drawn to a method for making an electrical module, classified in class 29, subclass 846.
  - III. Claims 29-42, drawn to an electronic module, classified in class 361, subclass 306.1.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions Groups I-II and Group III are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the process as claimed can be used to make other and material different product such as an embedded capacitor between first and second unsintered ceramic layers by heating the unsintered ceramic layers.
3. Inventions Group I and Group II are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other

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combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because Group I does not require a dielectric constant of the second dielectric layer being greater than a dielectric constant of the first dielectric layer. The subcombination has separate utility such as an electric module having the dielectric constant of the second dielectric layer being greater than the dielectric constant of the first dielectric layer.

4. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

5. Because these inventions are distinct for the reasons given above and the search required for Groups I is not required for Group II or Group III, and vice versa restriction for examination purposes as indicated is proper.

6. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

7. During a telephone conversation with Christopher F. Regan on October 12, 2004 a provisional election was made without traverse to prosecute the invention of Group II, claims 29-42. Affirmation of this election must be made by applicant in replying to this Office action. Claims 1-28 withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of

the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

***Claim Rejections - 35 USC § 103***

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 29-31, and 34-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takagi et al. (US 4,800,459) in view of Klee et al. (US 6,125,027).

Takagi et al. disclose in fig. 1, 2, an electronic module comprising a low temperature co-fired ceramic substrate (LTCC – col. 6 lines 55-65); at least one capacitive structure embedded in the LTCC substrate; and at least one electronic

device mounted on the LTCC substrate and electrically connected to the at least one embedded capacitive structure.

Takagi et al. disclose the claimed invention except for the capacitor comprising a pair of electrode layers, an inner dielectric layer between said pair of electrode layers, and at least one outer dielectric layer adjacent at least one of said electrode layers and opposite said inner dielectric layer, said at least one outer dielectric layer having a dielectric constant less than a dielectric constant of said inner dielectric layer, and at least one electronic device mounted on the LTCC substrate and electrically connected to the at least one embedded capacitive structure.

Klee et al. teach a known capacitor used in the electronic art. The capacitor comprises a pair of electrode layers (3, 5), an inner dielectric layer (4) between said pair of electrode layers, and at least one outer dielectric layer (1, 2) adjacent at least one of said electrode layers and opposite said inner dielectric layer, said at least one outer dielectric layer having a dielectric constant less than a dielectric constant of said inner dielectric layer.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the module of Alexander by using the capacitor of Klee et al., since such a modification would provide a system with a capacitor having a high surface capacitance, a small thickness, and a low tolerance.

Regarding claim 30, Klee et al. teach that the at least one outer dielectric layer comprises at least one outer dielectric layer adjacent each of the electrode layers and opposite the inner dielectric layer.

Regarding claim 31, Klee et al. teach that each one outer dielectric layer comprises a first outer dielectric layer (1, 6) and a second outer dielectric layer (2, (layer on top of 5 see examples), between the first outer dielectric layer and a respective electrode layer.

Regarding claim 34, Klee et al. teach that the inner dielectric layer has a dielectric constant of greater than about 2000 (see dielectric materials).

Regarding claim 35, Takagi et al. disclose the LTCC substrate further comprises at least one signal trace (21-22).

Regarding claim 36, Takagi et al. disclose the inner dielectric layer and at least one outer dielectric layer each comprise less than about 15 % by weight of glass (element 6 – organic polymer, and element 4 -- barium titanate).

Regarding claim 37, Klee et al. teach that the at least one outer dielectric layer comprises at least a silicon dioxide (col. 8 line 10).

Regarding claim 38, Klee et al. teach that the inner dielectric is a barium titanate (see col. 3 lines 1-5).

Regarding claim 39, Klee et al. teach the electrode layers are formed from Ag (see col. 4 lines 50-52).

Regarding claim 40, Klee et al. teach that the inner dielectric layer has a thickness of less than about 3 mils (.7mils – col. 4 lines 55-65).

Regarding claim 41, Takagi et al. disclose conductive vias for electrically connecting the at least one electronic device and the at least one embedded capacitor.

Regarding claim 42, Klee et al. teach that the capacitive structure has a capacitive density of greater than about  $1000 \text{ pF/mm}^2$ . Although Klee et al. does not expressly state the capacitive density is greater than about  $1000 \text{ pF/mm}^2$ , it is an inherent feature of the capacitor of Klee et al. Klee et al. teach the claimed structure (including dimensions); therefore it possesses the same electrical properties.

4. Claims 29-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Klee et al. (DE 19630883) in view of Alexander (US 5,661,882).

Klee et al. disclose a capacitor comprises a pair of electrode layers (3, 5), an inner dielectric layer (4) between said pair of electrode layers, and at least one outer dielectric layer (1, 2) adjacent at least one of said electrode layers and opposite said inner dielectric layer, said at least one outer dielectric layer having a dielectric constant less than a dielectric constant of said inner dielectric layer.

Klee et al. disclose the claimed invention except for an electronic module comprising a low temperature co-fired ceramic (LTCC) substrate; the capacitive structure embedded in the LTCC substrate; and at least one electronic device mounted on the LTCC substrate and electrically connected to the at least one embedded capacitive structure.

Alexander teaches that it is known in the electronic art to embed a capacitor within a LTCC substrate, wherein the substrate has at least one electronic device mounted on the LTCC substrate, and electrically connected to the at least one embedded capacitive structure.



It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use the capacitor of Klee et al. in the substrate of Alexander, since such a modification would provide an electrical system for the capacitor to operate in and provide a system with a capacitor having a high surface capacitance, a small thickness, and a low tolerance.

Regarding claim 30, Klee et al. disclose the at least one outer dielectric layer comprises at least one outer dielectric layer adjacent each of the electrode layers and opposite the inner dielectric layer.

Regarding claim 31, Klee et al. disclose each one outer dielectric layer comprises a first outer dielectric layer (1, 6) and a second outer dielectric layer (2, (layer on top of 5 see examples), between the first outer dielectric layer and a respective electrode layer.

Regarding claim 32, Klee et al. disclose the second dielectric layer (bottom – alumina 9.3 – 11.5) has a dielectric constant greater than the dielectric constant of the first dielectric layer (bottom --  $\text{BaF}_2$  ~7.33 & top  $\text{SiO}_2$  ~5). Klee et al. disclose the claimed invention except for the top second dielectric layer is formed from a material that has a dielectric constant than that of the first dielectric layer. Klee et al. teach that a glass layer is formed on the  $\text{SiO}_2$  layer. Klee et al. teach that alumina is a known glass layer. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to form an alumina over the silicon dioxide layer, since, insulator materials are selected based on design considerations and trade offs between cost, mechanical properties, and dielectric properties; and it would have been obvious to one

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having ordinary skill in the art at the time the invention was made to select a material having an appropriate dielectric constant and dielectric strength, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Regarding claim 33, Klee et al. disclose the first outer dielectric layer (lower & upper) has a dielectric constant of (alumina) 11-11.5, the first outer dielectric (lower) has a dielectric of (BaF<sub>2</sub>) 7.33. Klee et al. disclose the claimed invention except for the upper first outer dielectric layer has a dielectric in the range of 7-10. Klee et al. teach that the materials used in the protective layer are not particularly limited. It would have been obvious to a person of ordinary skill in the art to form a first outer dielectric layer (upper) from a material having a dielectric in the range of 7-10, since, insulator materials are selected based on design considerations and trade offs between cost, mechanical properties, and dielectric properties (being strictly limited by the voltage level of the device being insulated); and it would have been obvious to one having ordinary skill in the art at the time the invention was made to select a material having an appropriate dielectric constant and dielectric strength, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

***Conclusion***

In order to ensure full consideration of any amendments, affidavits, or declaration, or other documents as evidence of patentability, such documents must be submitted in response to this Office action. Submissions after the next Office action, which is intended to be a final action, will be governed by the requirements of 37 CFR 1.116 which will be strictly enforced.

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

5,601,673 – discloses a module comprising a cavity for a passive component.

6,387,507 – discloses a ceramic package having a passive component.

5,144,526 – discloses a capacitor embedded in a LTCC substrate.

6,252,761 -- discloses a capacitor embedded in a LTCC substrate.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric W Thomas whose telephone number is 571-272-1985. The examiner can normally be reached on M,Tu,Sat 9 am - 9:30 pm; W, Th, F 6 pm -10:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dean Reichard can be reached on 571-272-1984. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



10/25/07

Eric W Thomas  
Examiner  
Art Unit 2831

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